UNIVERSITI SAINS MALAYSIA

First Semester Examination
2014/2015 Academic Session

December 2014/January 2015

CMT221/CMM222 – Database Organisation & Design
[Organisasi & Reka Bentuk Pangkalan Data]

Duration : 2 hours
[Masa : 2 jam]

INSTRUCTIONS TO CANDIDATE:
[ARAHAN KEPADA CALON:]

- Please ensure that this examination paper contains **FOUR** questions in **TEN** printed pages before you begin the examination.

  *[Sila pastikan bahawa kertas peperiksaan ini mengandungi **EMPAT** soalan di dalam **SEPULUH** muka surat yang bercetak sebelum anda memulakan peperiksaan ini.]*

- Answer **ALL** questions.

  *[Jawab **SEMUA** soalan.]*

- You may answer the questions either in English or in Bahasa Malaysia.

  [Anda dibenarkan menjawab soalan sama ada dalam bahasa Inggeris atau bahasa Malaysia.]

- In the event of any discrepancies, the English version shall be used.

  [Sekiranya terdapat sebarang percanggahan pada soalan peperiksaan, versi bahasa Inggeris hendaklah diguna pakai.]

1. (a) List **two** (**2**) reasons why null values might be introduced into the database. Can a primary key consist of null values? Why? Give an example to explain your reason.

(4/100)

(b) Using the following business rules, draw an extended entity-relationship (EER) model. State any assumptions necessary to support your model.

- A large company has several parking lots which are used by staff.
- Each parking lot has a unique name, location and capacity.
- Each parking lot has parking spaces, which are uniquely identified using a space number.
- Members of staff can request the use of a parking space. Each member of staff has a unique staff number, name, telephone extension number and a vehicle registration number.
- The majority of parking spaces are under cover and each can be allocated for use by a member of staff for a monthly fee.
- Parking spaces that are not under cover are free to use when available.
- Up to 20 covered parking spaces are available for use by visitors to the company. However, only members of staff are able to book out a space for the day of the visit. There is no charge for this type of booking but the member of staff must provide the visitor's vehicle registration number.

You may draw the EER using Crow's Foot or UML notation. Show clearly all the entities, attributes, relationship labels, cardinalities, including primary key and foreign key as well as the disjoint and completeness constraints, if applicable.

(12/100)

(c) Any weak entity set can be converted into a strong entity set by simply adding appropriate attributes. Do you agree with the statement? Why then do we have weak entity sets in database modeling?

(4/100)

(d) You have just been hired as the IT Manager in a SME (small & medium enterprise) to handle its information needs. Upon reporting for duty, you realise that you are the only IT specialist there besides one junior technical staff. You reckon that the programmer, systems analyst, and DBA will all be bundled into one, YOU! You also noticed that the clerks and other managers rely a lot on using spreadsheets to manage their data. Being a graduate in Computer Science where you've learned about the benefits of having a database system, you're planning to introduce the usage of a DBMS in the company.

(i) How would you convince your top management that having a database system can enhance and support the work of the company at all levels?

(ii) What special considerations must you take into account when introducing a DBMS into the organisation?

(5/100)

2. (a) Consider the following three relations. The primary keys for relations P, Q, and R are (B, C), C, and A respectively. Compute and illustrate the relations generated by the following operations:

P

A	B	C
G	520	5
E	540	4
E	550	5
D	510	4
G	510	5
G	510	6
D	530	4
D	530	5
D	530	6

Q

C
4
5
6

R

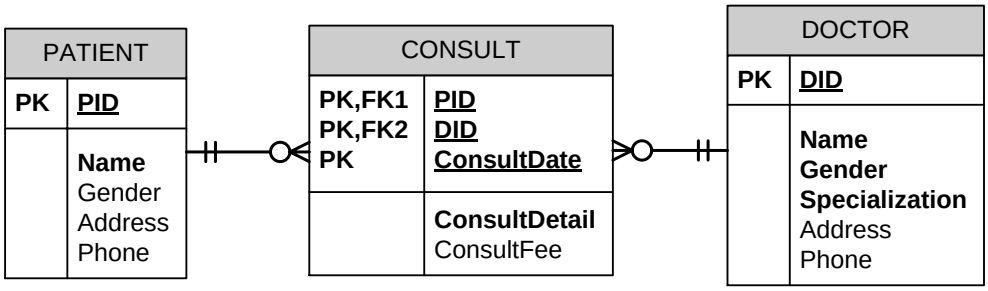
A	B
G	510
D	530

(i) $R \times Q$

(ii) $P \cup (R \times Q)$

(5/100)

(b) Refer to the ER diagram below. Provide SQL commands to implement the following tasks.



(i) Find a list of doctors with cardiology as their specialization. The list should contain all the fields in the `DOCTOR` table.

(ii) Display the doctor data in a more readable format: doctor's name, gender, and specialization. Also, sort the data, first by specialization, then by gender (female first), and lastly by name, in increasing order.

(iii) Provide 50% discount on the consultation fee for the consultations completed on 31-Aug-2014.

(iv) Find the names of all patients who consulted any doctor on 16-Sep-2014.

(v) Find the names of all patients who have not consulted any doctor.

(vi) Find the doctors who received the highest consultation fee.

(20/100)

3. (a) Consider the following relations that contain the information on rackets at two different branches of a sport company, A and B.

```
RACKET_AT_A (RACKET_ID, RACKET_MODEL, RACKET_PRICE)
RACKET_AT_B (R_ID, R_MODEL, R_PRICE)
```

`RACKET_AT_A` contains rows as follows:

RACKET_ID	RACKET_MODEL	RACKET_PRICE
R101	Yonex Racket Nanoray 20	190
R102	RSL Super Power 8080	100
R103	Protech Racket ICON i6 YellowBlack	120
R104	Yonex Racket Nanospeed 5500 Gold White	399
R105	Wilson Recon BLX Gold/Black	349
R106	Prokennex Nano X2 9000 Pro Dark Orange	599.99
R107	Yonex Arc Saber 5 Racquet	499
R110	Pro Kennex TM-555	80

`RACKET_AT_B` contains rows as follows:

R_ID	R_MODEL	R_PRICE
R101	Yonex Racket Nanoray 20	199.99
R102	RSL Super Power 8080	99.8
R103	Protech Racket ICON i6 YellowBlack	125.99
R106	Prokennex Nano X2 9000 Pro Dark Orange	599.99
R107	Yonex Arc Saber 5 Racquet	499
R108	Prince Phantom 750	188.99
R109	Protech Saturn White Blue Racket	169.99
R111	Wilson Isotope BLX Fire Red/Silver	279.99

(i) Using the `INTERSECT` operator, provide a SQL command which displays the rackets located at branch A and branch B. The execution of your SQL command must produce the following output.

ID	MODEL
R101	Yonex Racket Nanoray 20
R102	RSL Super Power 8080
R103	Protech Racket ICON i6 YellowBlack
R106	Prokennex Nano X2 9000 Pro Dark Orange
R107	Yonex Arc Saber 5 Racquet

(ii) Provide a SQL command which displays the rackets located at branch B but not in branch A.

(iii) Using a JOIN operator, provide a SQL command which displays the following output.

A_ID	A_PRICE	B_ID	B_PRICE
R101	190	R101	199.99
R102	100	R102	99.8
R103	120	R103	125.99
R106	599.99	R106	599.99
R107	499	R107	499
null	null	R108	188.99
null	null	R109	169.99
null	null	R111	279.99
R105	349	null	null
R104	399	null	null
R110	80	null	null

(7/100)

(b) Describe and illustrate the process of normalizing the table below to 3NF. List down any assumptions you make about the data shown in the table.

Member_ID	Member_Name	Borrow_ID	Borrow_Date	Return_Date	Book_ID	Book_Name	Publisher_ID	Publisher_Name
M10011	Captain America	101	23-Sep-14	30-Sep-14	B50001	How to Make a Shield	P101	World Pub.
M10011	Captain America	101	23-Sep-14	30-Sep-14	B50005	Sleeping Handsome	P102	Fast Print
M10012	Thor	103	1-Oct-14	7-Oct-14	B50001	How to Make a Shield	P101	World Pub.
M10012	Thor	103	1-Oct-14	7-Oct-14	B50006	Hammer Attack	P102	Fast Print
M10011	Captain America	104	8-Oct-14	15-Oct-14	B50001	How to Make a Shield	P101	World Pub.
M10013	Hulk	105	9-Oct-14	16-Oct-14	B50007	Anger Management	P102	Fast Print

(18/100)

4. (a) Describe the characteristics of predictive analytics. What is the impact of Big Data (social media) in predictive analytics?

(5/100)

(b) Discuss the distinction between centralized and decentralized conceptual database design.

(6/100)

(c) List and briefly explain the four steps performed during the logical design stage.

(6/100)

(d) Your data warehousing project group is debating whether to create a prototype of a data warehouse before its implementation. The project group members are especially concerned about the need to acquire some data warehousing skills before implementing the enterprise-wide data warehouse. What would you recommend? Explain your recommendations.

(8/100)

1. (a) Senaraikan **dua** (**2**) sebab mengapa nilai nul mungkin diperkenalkan ke dalam pangkalan data. Bolehkah suatu kunci primer mengandungi nilai nul? Kenapa? Beri satu contoh untuk menjelaskan sebab yang anda berikan.

(4/100)

(b) Dengan menggunakan peraturan urusan yang berikut, lukis satu model entiti-perhubungan terluas (EER). Nyatakan sebarang andaian yang perlu untuk menyokong model anda.

- Sebuah syarikat yang besar mempunyai beberapa medan parkir yang digunakan oleh kakitangannya.
- Setiap medan parkir mempunyai nama yang unik, lokasi, dan kapasiti.
- Setiap medan parkir mempunyai ruang parkir, yang dikenali secara unik dengan nombor ruang.
- Kakitangan syarikat boleh memohon penggunaan sesuatu ruang parkir. Setiap kakitangan mempunyai nombor staf yang unik, nama, nombor sambungan telefon dan nombor pendaftaran kenderaan.
- Kebanyakan ruang parkir adalah berbumbung dan setiap satunya boleh diperuntukkan untuk kegunaan staf pada kadar yuran bulanan.
- Ruang parkir terbuka adalah percuma dan boleh digunakan jika kosong.
- Sebanyak 20 ruang parkir berbumbung disediakan untuk kegunaan pelawat syarikat. Walau bagaimanapun, hanya staf sahaja yang boleh menempah sesuatu ruang tersebut untuk hari lawatan. Tiada bayaran dikenakan bagi tempahan sebegini tetapi staf tersebut perlu memberi nombor pendaftaran kenderaan pelawat berkenaan.

Anda boleh melukis gambar rajah EER menggunakan notasi *Crow's Foot* atau UML. Tunjukkan dengan jelas semua entiti, atribut, label perhubungan, kardinaliti termasuk kunci primer dan kunci asing serta kekangan tak-bercantum dan kekangan kelengkapan, sekiranya sesuai.

(12/100)

(c) Sebarang set entiti lemah boleh ditukar kepada set entiti kuat dengan hanya menambah atribut yang bersesuaian. Setujukah anda dengan kenyataan tersebut? Kenapa pula kita memerlukan set entiti lemah dalam pemodelan pangkalan data?

(4/100)

(d) Anda baru sahaja diambil bekerja sebagai Pengurus IT di sebuah IKS (industri kecil & sederhana) untuk menangani keperluan maklumat organisasi tersebut. Sebaik sahaja anda melapor diri, anda sedar bahawa andalah satu-satunya pakar IT di situ selain dari seorang kakitangan teknikal muda. Anda menjangka bahawa pengatur cara, penganalisis sistem dan pentadbir pangkalan data adalah semua dalam satu, iaitu ANDA! Anda juga perhatikan yang kerani-kerani dan pengurus-pengurus lain sangat bergantung kepada penggunaan lembaran kerja untuk mengurus data mereka. Memandangkan anda adalah graduan Sains Komputer yang telah mempelajari tentang kebaikan adanya sistem pangkalan data, anda merancang untuk memperkenalkan penggunaan DBMS di syarikat itu.

(i) Bagaimanakah akan anda yakinkan pengurusan atasan bahawa sistem pangkalan data boleh mempertingkatkan dan menyokong kerja-kerja syarikat pada semua peringkat?

(ii) Apakah pertimbangan-pertimbangan khas yang mesti anda ambil kira apabila memperkenalkan suatu DBMS dalam syarikat itu?

(5/100)

2. (a) Pertimbangkan ketiga-tiga hubungan berikut. Kunci primer hubungan P, Q, dan R ialah (B, C), C, dan A masing-masing. Kirakan dan ilustrasikan hubungan-hubungan yang dijanakan oleh operasi-operasi berikut:

P

A	B	C
G	520	5
E	540	4
E	550	5
D	510	4
G	510	5
G	510	6
D	530	4
D	530	5
D	530	6

Q

C
4
5
6

R

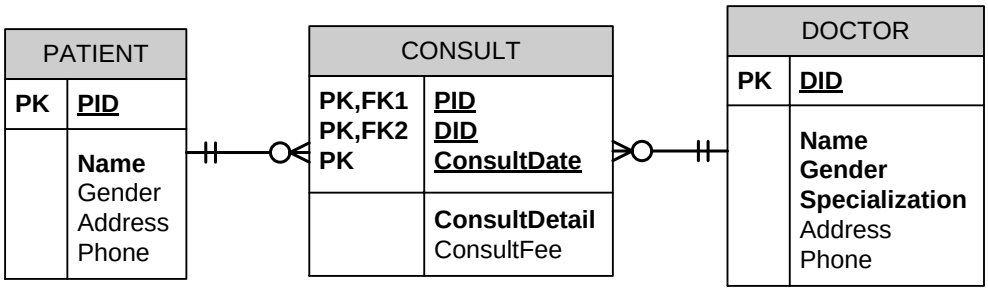
A	B
G	510
D	530

(i) $R \times Q$

(ii) $P \cup (R \times Q)$

(5/100)

(b) Rujuk gambar rajah hubungan entiti di bawah. Berikan arahan-arahan SQL untuk melaksanakan tugas-tugas berikut.



(i) Cari satu senarai doktor yang pengkhususannya ialah kardiologi. Senarai itu hendaklah mengandungi semua atribut dalam jadual `DOCTOR`.

(ii) Paparkan data doktor dalam format yang lebih senang dibaca: nama doktor, jantina, dan pengkhususan. Juga, susunkan data dalam susunan meningkat, mengikut pengkhususan, jantina (perempuan didahulukan), dan akhirnya nama.

(iii) Berikan diskaun 50% atas yuran konsultasi untuk konsultasi rawatan yang dibuat pada 31-Ogos-2014.

(iv) Cari nama semua pesakit yang menjumpai sebarang doktor pada 16-September-2014.

(v) Cari nama semua pesakit yang tidak pernah menjumpai sebarang doktor.

(vi) Cari doktor-doktor yang menerima yuran konsultasi yang paling tinggi.

(20/100)

3. (a) Pertimbangkan hubungan-hubungan berikut yang mengandungi maklumat raket di dua buah cawangan yang berlainan bagi suatu syarikat sukan, A dan B.

```
RACKET_AT_A (RACKET_ID, RACKET_MODEL, RACKET_PRICE)
RACKET_AT_B (R_ID, R_MODEL, R_PRICE)
```

`RACKET_AT_A` mengandungi baris-baris berikut:

RACKET_ID	RACKET_MODEL	RACKET_PRICE
R101	Yonex Racket Nanoray 20	190
R102	RSL Super Power 8080	100
R103	Protech Racket ICON i6 YellowBlack	120
R104	Yonex Racket Nanospeed 5500 Gold White	399
R105	Wilson Recon BLX Gold/Black	349
R106	Prokennex Nano X2 9000 Pro Dark Orange	599.99
R107	Yonex Arc Saber 5 Racquet	499
R110	Pro Kennex TM-555	80

RACKET_AT_B mengandungi baris-baris berikut:

R_ID	R_MODEL	R_PRICE
R101	Yonex Racket Nanoray 20	199.99
R102	RSL Super Power 8080	99.8
R103	Protech Racket ICON i6 YellowBlack	125.99
R106	Prokennex Nano X2 9000 Pro Dark Orange	599.99
R107	Yonex Arc Saber 5 Racquet	499
R108	Prince Phantom 750	188.99
R109	Protech Saturn White Blue Racket	169.99
R111	Wilson Isotope BLX Fire Red/Silver	279.99

(i) Dengan menggunakan operator INTERSECT, berikan satu arahan SQL yang memaparkan raket-raket yang terdapat di cawangan A dan cawangan B. Pelaksanaan arahan SQL tersebut mesti menghasilkan output berikut.

ID	MODEL
R101	Yonex Racket Nanoray 20
R102	RSL Super Power 8080
R103	Protech Racket ICON i6 YellowBlack
R106	Prokennex Nano X2 9000 Pro Dark Orange
R107	Yonex Arc Saber 5 Racquet

(ii) Berikan satu arahan SQL yang memaparkan raket-raket yang terdapat di cawangan B tetapi tidak terdapat di cawangan A.

(iii) Dengan menggunakan operator JOIN, berikan satu arahan SQL yang memaparkan output berikut.

A_ID	A_PRICE	B_ID	B_PRICE
R101	190	R101	199.99
R102	100	R102	99.8
R103	120	R103	125.99
R106	599.99	R106	599.99
R107	499	R107	499
null	null	R108	188.99
null	null	R109	169.99
null	null	R111	279.99
R105	349	null	null
R104	399	null	null
R110	80	null	null

(7/100)

(b) Huraikan dan ilustrasikan proses penormalan jadual di bawah sehingga 3NF. Senaraikan sebarang andaian yang anda buat terhadap data yang ditunjukkan dalam jadual tersebut.

Member_ID	Member_Name	Borrow_ID	Borrow_Date	Return_Date	Book_ID	Book_Name	Publisher_ID	Publisher_Name
M10011	Captain America	101	23-Sep-14	30-Sep-14	B50001	How to Make a Shield	P101	World Pub.
M10011	Captain America	101	23-Sep-14	30-Sep-14	B50005	Sleeping Handsome	P102	Fast Print
M10012	Thor	103	1-Oct-14	7-Oct-14	B50001	How to Make a Shield	P101	World Pub.
M10012	Thor	103	1-Oct-14	7-Oct-14	B50006	Hammer Attack	P102	Fast Print
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M10013	Hulk	105	9-Oct-14	16-Oct-14	B50007	Anger Management	P102	Fast Print

(18/100)

4. (a) Jelaskan ciri-ciri analisis ramalan. Apakah kesan Big Data (media sosial) dalam analisis ramalan?

(3/100)

(b) Bincangkan perbezaan antara reka bentuk pangkalan data konseptual berpusat dan nyah pusat.

(6/100)

(c) Senarai dan terangkan secara ringkas empat langkah yang dilakukan semasa peringkat reka bentuk logik.

(8/100)

(d) Kumpulan projek penggudangan data anda berdebat sama ada untuk membuat prototaip sebuah gudang data sebelum pelaksanaannya. Ahli-ahli kumpulan projek sangat prihatin mengenai keperluan untuk memperolehi beberapa kemahiran penggudangan data sebelum melaksanakan penggudangan data secara meluas dalam organisasi. Apakah yang akan anda cadangkan? Jelaskan cadangan anda.

(8/100)